

# **ENCODER**

## **SSI Multiturn Encoder**



### **Series Sendix SSI F36**

#### **Key-Features:**

- **Solid and hollow shaft:**  
maximum diameter 10 mm
- **Housing diameter 36 up to 46 mm**
- **Protection class IP67**
- **Temperature range -40...+90 °C**
- **High insensitivity**
- **Maximum revolution speed 12.000 U/min**

#### **Content:**

|                          |              |
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29.03.17

# Absolute encoders – multiturn

|  |  |                                 |
|--|--|---------------------------------|
| <b>Compact electronic multiturn, optical</b> | <b>Sendix F3663 / F3683 (shaft / hollow shaft)</b> | <b>SSI / BiSS + incremental</b> |
|--|--|---------------------------------|



The Sendix F36 multiturn with the patented Intelligent Scan Technology™ is an optical multiturn encoder in miniature format, without gears and with 100% insensitivity to magnetic fields.

With a size of just 36 x 42 mm it offers a through hollow shaft of up to 8 mm or a blind hollow shaft of up to 10 mm.



|              |                       |                                    |                             |                          |                             |                      |                             |        |                              |   |
|--------------|-----------------------|------------------------------------|-----------------------------|--------------------------|-----------------------------|----------------------|-----------------------------|--------|------------------------------|---|
|              |                       |                                    |                             |                          |                             |                      |                             |        |                              |   |
| Safety-Lock™ | High rotational speed | Temperature range<br>-40°... +90°C | High protection level<br>IP | High shaft load capacity | Shock / vibration resistant | Magnetic field proof | Reverse polarity protection | SinCos | Intelligent Scan Technology™ | Surface protection salt spray-tested optional |

### Reliable and insensitive

- Sturdy bearing construction in Safety-Lock™ design for resistance against vibration and installation errors.
- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range -40°C ... +90°C.
- Patented Intelligent Scan Technology™ (with all singleturn and multiturn functions on one single OptoASIC) - offering highest reliability, a high resolution up to 41 bits and 100% magnetic field insensitivity.

### Optimized performance

- High precision with data refresh rate of the position value ≤ 1µs.
- High resolution feedback in real-time via incremental outputs SinCos and RS422.
- Short control cycles, clock frequency with SSI up to 2 MHz / with BiSS up to 10 MHz.

|                      |                |                   |
|----------------------|----------------|-------------------|
| <b>Order code</b>    | <b>8.F3663</b> | <b>.XXXX.XXX2</b> |
| <b>Shaft version</b> | Type           | a b c d e f g     |

|   |  |  |  |
|---|--|--|--|
| <p><b>a Flange</b></p> <p>1 = clamping flange, IP67, ø 36 mm [1.42"]</p> <p>3 = clamping flange, IP65, ø 36 mm [1.42"]</p> <p>2 = synchro flange, IP67, ø 36 mm [1.42"]</p> <p><b>4 = synchro flange, IP65, ø 36 mm [1.42"]</b></p> <p><b>b Shaft (ø x L), with flat</b></p> <p>1 = ø 6 x 12.5 mm [0.24 x 0.49"]</p> <p><b>3 = ø 8 x 15 mm [0.32 x 0.59"]</b></p> <p>5 = ø 10 x 20 mm [0.39 x 0.79"]</p> <p>2 = ø 1/4" x 12.5 mm [0.49"]</p> <p>4 = ø 3/8" x 5/8"</p> | <p><b>c Interface / power supply</b></p> <p>1 = SSI, BiSS / 5 V DC</p> <p><b>2 = SSI, BiSS / 10 ... 30 V DC</b></p> <p>3 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC</p> <p>4 = SSI, BiSS + 2048 ppr. SinCos / 10 ... 30 V DC</p> <p>5 = SSI, BiSS / 5 V DC, with sensor output</p> <p>6 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC, with sensor output</p> <p>7 = SSI, BiSS + 2048 ppr. RS422 / 5 V DC</p> <p>8 = SSI, BiSS + 2048 ppr. RS422 / 10 ... 30 V DC</p> <p><b>d Type of connection</b></p> <p><b>1 = tangential cable, 1 m [3.28'] PUR</b></p> <p>3 = tangential cable, 5 m [16.40'] PUR</p> <p>U = tangential cable, 10 m [32.81'] PUR</p> <p>5 = tangential cable, 1 m [3.28'] PUR<br/>with M12 connector for central fastening, 8-pin<sup>1)</sup></p> | <p><b>e Code</b></p> <p>B = SSI, binary</p> <p>C = BiSS, binary</p> <p><b>G = SSI, gray</b></p> <p><b>f Resolution (singleturn)</b></p> <p>B = 9 bit ST</p> <p>A = 10 bit ST</p> <p>2 = 12 bit ST</p> <p><b>3 = 13 bit ST</b></p> <p>4 = 14 bit ST</p> <p>7 = 17 bit ST</p> <p><b>g Resolution (multiturn)</b></p> <p><b>2 = 12 bit MT</b></p> <p>6 = 16 bit MT</p> <p>4 = 24 bit MT</p> | <p><i>Optional on request</i></p> <ul style="list-style-type: none"> <li>- surface protection salt spray tested</li> <li>- other singleturn resolutions</li> </ul> |
|---|--|--|--|

1) Only with interface 1 and 2.

# Absolute encoders – multiturn

**Compact electronic multiturn, optical**

**Sendix F3663 / F3683 (shaft / hollow shaft)**

**SSI / BiSS + incremental**

**Order code**  
**Hollow shaft**

**8.F3683** . **XXXX** . **XXXX2**  
Type  
a b c d e f g

**a Flange**

- 1 = with spring element, short, IP65
- 3 = with spring element, long, IP65
- 2 = with stator coupling, IP65, ø 46 mm [1.81"]**

**b Through hollow shaft**

- 1 = ø 6 mm [0.24"]
- 3 = ø 8 mm [0.32"]
- 2 = ø 1/4"
- Blind hollow shaft (insertion depth max. 14.5 mm [0.57"])
- 4 = ø 10 mm [0.39"]**

**c Interface / power supply**

- 1 = SSI, BiSS / 5 V DC
- 2 = SSI, BiSS / 10 ... 30 V DC**
- 3 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC
- 4 = SSI, BiSS + 2048 ppr. SinCos / 10 ... 30 V DC
- 5 = SSI, BiSS / 5 V DC, with sensor output
- 6 = SSI, BiSS + 2048 ppr. SinCos / 5 V DC, with sensor output
- 7 = SSI, BiSS + 2048 ppr. RS422 / 5 V DC
- 8 = SSI, BiSS + 2048 ppr. RS422 / 10 ... 30 V DC

**d Type of connection**

- 1 = tangential cable, 1 m [3.28'] PUR**
- 3 = tangential cable, 5 m [16.40'] PUR
- U = tangential cable, 10 m [32.81'] PUR
- 5 = tangential cable, 1 m [3.28'] PUR with M12 connector for central fastening, 8-pin <sup>1)</sup>

**e Code**

- B = SSI, binary
- C = BiSS, binary
- G = SSI, gray**

*Optional on request*

- surface protection salt spray tested
- other singleturn resolutions

**f Resolution (singleturn)**

- B = 9 bit ST
- A = 10 bit ST
- 2 = 12 bit ST
- 3 = 13 bit ST**
- 4 = 14 bit ST
- 7 = 17 bit ST

**g Resolution (multiturn)**

- 2 = 12 bit MT**
- 6 = 16 bit MT
- 4 = 24 bit MT

**Mounting accessory for shaft encoders**

Order no.

**Coupling**

Bellows coupling ø 19 mm [0.75"] for shaft 8 mm [0.32"]

**8.0000.1102.0808**

**Mounting accessory for hollow shaft encoders**

Dimensions in mm [inch]

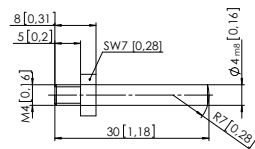
Order no.

**Cylindrical pin, long**

for flange with spring element (flange type 1 + 3)

with fixing thread

**8.0010.4700.0000**



**Connection technology**

Order no.

**Cordset, pre-assembled**

M12 female connector with coupling nut, 8-pin  
2 m [6.56'] PUR cable

**05.00.6051.8211.002M**

**Connector, self-assembly (straight)**

M12 female connector with coupling nut, 8-pin

**05.CMB 8181-0**

**Technical data**

**Mechanical characteristics**

**Maximum speed**

shaft version without shaft seal (IP65) 12000 min<sup>-1</sup>  
or blind hollow shaft version 10000 min<sup>-1</sup> (continuous)

shaft version with shaft seal (IP67) 10000 min<sup>-1</sup>  
or hollow shaft version 8000 min<sup>-1</sup> (continuous)

**Starting torque at 20°C [68°F]**

without shaft seal < 0.007 Nm  
with shaft seal (IP67) < 0.01 Nm

**Shaft load capacity**

radial 40 N  
axial 20 N

**Weight**

approx. 0.2 kg [7.06 oz]

**Protection**

housing side IP67  
acc. to EN 60529 shaft side IP65 (solid shaft version opt. IP67)

**Working temperature range**

-40°C ... +90°C [-40°F ... +194°F]

**Materials**

shaft / hollow shaft stainless steel  
flange aluminum  
housing zinc die-cast  
cable PUR

**Shock resistance acc. to EN 60068-2-27**

2500 m/s<sup>2</sup>, 6 ms

**Vibration resistance acc. to EN 60068-2-6**

100 m/s<sup>2</sup>, 55 ... 2000 Hz

1) Only with output circuits 1 and 2.

# Absolute encoders – multiturn

## Compact electronic multiturn, optical

## Sendix F3663 / F3683 (shaft / hollow shaft)

## SSI / BiSS + incremental

### Electrical characteristics

|  |   |                          |
|--|---|--------------------------|
| <b>Power supply</b>                                    | 5 V DC ( $\pm 5\%$ ) or 10 ... 30 V DC                |                          |
| <b>Current consumption</b><br>(no load)                | 5 V DC<br>10 ... 30 V DC                              | max. 60 mA<br>max. 30 mA |
| <b>Reverse polarity protection of the power supply</b> | yes (only with 10 ... 30 V DC)                        |                          |
| <b>Short-circuit proof outputs</b>                     | yes <sup>1)</sup>                                     |                          |
| <b>UL approval</b>                                     | file 224618   |                          |
| <b>CE compliant acc. to</b>                            | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |                          |

### SSI interface

|  |  |  |
|--|--|--|
| <b>Output driver</b>                     | RS485 transceiver type                                     |  |
| <b>Permissible load / channel</b>        | max. +/- 30 mA   |  |
| <b>Signal level</b>                      | HIGH<br>LOW with $I_{Load} = 20\text{ mA}$                 | typ 3.8 V<br>typ 1.3 V                   |
| <b>Resolution singleturn</b>             | 10 ... 17 bit  |  |
| <b>Number of revolutions (multiturn)</b> | max. 24 bit  |  |
| <b>Code</b>                              | binary or gray   |  |
| <b>SSI clock rate</b>                    | 50 kHz ... 2 MHz   |  |
| <b>Data refresh rate</b>                 | ST resolution $\leq 14$ bit<br>ST resolution $\geq 15$ bit | $\leq 1\ \mu\text{s}$<br>4 $\mu\text{s}$ |
| <b>Monoflop time</b>                     | $\leq 15\ \mu\text{s}$                                     |  |

**Note:** If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

### BiSS interface

|  |   |  |
|--|---|--|
| <b>Resolution singleturn</b>             | 10 ... 17 bit   |  |
| <b>Number of revolutions (multiturn)</b> | max. 24 bit   |  |
| <b>Code</b>                              | binary  |  |
| <b>BiSS Clock rate</b>                   | 50 kHz ... 10 MHz   |  |
| <b>Max. update rate</b>                  | $< 10\ \mu\text{s}$ , depends on the clock rate and the data length |  |
| <b>Data refresh rate</b>                 | ST resolution $\leq 14$ bit<br>ST resolution 17 bit                 | $\leq 1\ \mu\text{s}$<br>2.4 $\mu\text{s}$ |

**Note:**

- bidirectional, factory programmable parameters are: resolution, code, direction, alarms and warnings
- CRC data verification

### Incremental outputs (A/B), 2048 ppr

|                            | SinCos               | RS422<br>TTL-compatible             |
|----------------------------|----------------------|-------------------------------------|
| <b>Max. frequency -3dB</b> | 400 kHz              | 400 kHz                             |
| <b>Signal level</b>        | 1 Vpp ( $\pm 20\%$ ) | HIGH: min. 2.5 V<br>LOW: max. 0.5 V |
| <b>Short circuit proof</b> | yes <sup>1)</sup>    | yes <sup>1)</sup>                   |

### Status output

|                         |   |             |
|-------------------------|---|-------------|
| <b>Output driver</b>    | open collector, internal pull up resistor 22 kOhm |             |
| <b>Permissible load</b> | max. 20 mA  |             |
| <b>Signal level</b>     | HIGH<br>LOW                                       | +V<br>< 1 V |
| <b>Active</b>           | LOW   |             |

The status output serves to display various alarm or error messages. In normal operation the status output is HIGH (open collector with int. pull-up 22 kOhm).

An active status output (LOW) displays:  
LED fault (failure or ageing) – over-temperature – undervoltage  
In the SSI mode, the fault indication can only be reset by switching off the power supply to the device.

### SET input

|  |                   |   |
|--|-------------------|---|
| <b>Input</b>                               | active HIGH       |   |
| <b>Input type</b>                          | comparator        |   |
| <b>Signal level</b><br>(+V = power supply) | HIGH<br>LOW       | min. 60 % of +V, max: +V<br>max. 30 % of +V |
| <b>Input current</b>                       | $< 0.5\text{ mA}$ |   |
| <b>Min. pulse duration (SET)</b>           | 10 ms             |   |
| <b>Input delay</b>                         | 1 ms              |   |
| <b>New position data readable after</b>    | 1 ms              |   |
| <b>Internal processing time</b>            | 200 ms            |   |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET input has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out whilst the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

### DIR input

**Direction input:** A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

|                                  |      |
|----------------------------------|------|
| <b>Response time (DIR input)</b> | 1 ms |
|----------------------------------|------|

### Power-ON

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

Hot plugging of the encoder should be avoided.

1) Short circuit proof to 0 V or to output when power supply correctly applied.

# Absolute encoders – multiturn

**Compact  
electronic multiturn, optical**

**Sendix F3663 / F3683 (shaft / hollow shaft)**

**SSI / BiSS**

## Terminal assignment

| Interface | Type of connection | Features                   | Cable (isolate unused wires individually before initial start-up) |     |    |    |    |    |    |                     |                    |                     |                    |        |           |        |  |
|-----------|--------------------|----------------------------|---|-----|----|----|----|----|----|---------------------|--------------------|---------------------|--------------------|--------|-----------|--------|--|
| 1, 2      | 1, 3, U            | SET, DIR, Status           | Signal:   | 0 V | +V | C+ | C- | D+ | D- | SET                 | DIR                | Stat                | ⊥                  |        |           |        |  |
|           |                    |                            | Cable color:  | WH  | BN | GN | YE | GY | PK | BU                  | RD                 | VT                  | shield             |        |           |        |  |
| Interface | Type of connection | Features                   | M12 connector, 8-pin  |     |    |    |    |    |    |                     |                    |                     |                    |        |           |        |  |
| 1, 2      | 5                  | SET, DIR                   | Signal:   | 0 V | +V | C+ | C- | D+ | D- | SET                 | DIR                | ⊥                   |                    |        |           |        |  |
|           |                    |                            | Pin:  | 1   | 2  | 3  | 4  | 5  | 6  | 7                   | 8                  | PH                  |                    |        |           |        |  |
| Interface | Type of connection | Features                   | Cable (isolate unused wires individually before initial start-up) |     |    |    |    |    |    |                     |                    |                     |                    |        |           |        |  |
| 3, 4      | 1, 3, U            | SET, DIR, 2048 SinCos      | Signal:   | 0 V | +V | C+ | C- | D+ | D- | SET                 | DIR                | A                   | $\bar{A}$          | B      | $\bar{B}$ | ⊥      |  |
|           |                    |                            | Cable color:  | WH  | BN | GN | YE | GY | PK | BU                  | RD                 | BK                  | VT                 | GY-PK  | RD-BU     | shield |  |
| Interface | Type of connection | Features                   | Cable (isolate unused wires individually before initial start-up) |     |    |    |    |    |    |                     |                    |                     |                    |        |           |        |  |
| 5         | 1, 3, U            | SET, DIR, Sensor output    | Signal:   | 0 V | +V | C+ | C- | D+ | D- | SET                 | DIR                | 0 V <sub>sens</sub> | +V <sub>sens</sub> | ⊥      |           |        |  |
|           |                    |                            | Cable color:  | WH  | BN | GN | YE | GY | PK | BU                  | RD                 | VT                  | RD-BU              | shield |           |        |  |
| Interface | Type of connection | Features                   | Cable (isolate unused wires individually before initial start-up) |     |    |    |    |    |    |                     |                    |                     |                    |        |           |        |  |
| 6         | 1, 3, U            | 2048 SinCos, Sensor output | Signal:   | 0 V | +V | C+ | C- | D+ | D- | 0 V <sub>sens</sub> | +V <sub>sens</sub> | A                   | $\bar{A}$          | B      | $\bar{B}$ | ⊥      |  |
|           |                    |                            | Cable color:  | WH  | BN | GN | YE | GY | PK | BU                  | RD                 | BK                  | VT                 | GY-PK  | RD-BU     | shield |  |
| Interface | Type of connection | Features                   | Cable (isolate unused wires individually before initial start-up) |     |    |    |    |    |    |                     |                    |                     |                    |        |           |        |  |
| 7, 8      | 1, 3, U            | 2048 incr. RS422           | Signal:   | 0 V | +V | C+ | C- | D+ | D- | A                   | $\bar{A}$          | B                   | $\bar{B}$          | ⊥      |           |        |  |
|           |                    |                            | Cable color:  | WH  | BN | GN | YE | GY | PK | BK                  | VT                 | GY-PK               | RD-BU              | shield |           |        |  |

- +V: Encoder power supply +V DC
- 0 V: Encoder power supply ground GND (0 V)
- 0 V<sub>sens</sub> / +V<sub>sens</sub>: Using the sensor outputs of the encoder, the voltage present can be measured and if necessary increased accordingly.
- C+, C-: Clock signal
- D+, D-: Data signal
- A,  $\bar{A}$ : Incremental output channel A (cosine)
- B,  $\bar{B}$ : Incremental output channel B (sine)
- SET: Set input
- DIR: Direction input
- Stat: Status output
- PH ⊥: Plug connector housing (shield)

### Top view of mating side, male contact base



M12 connector, 8-pin

# Absolute encoders – multiturn

**Compact  
electronic multiturn, optical**

**Sendix F3663 / F3683 (shaft / hollow shaft)**

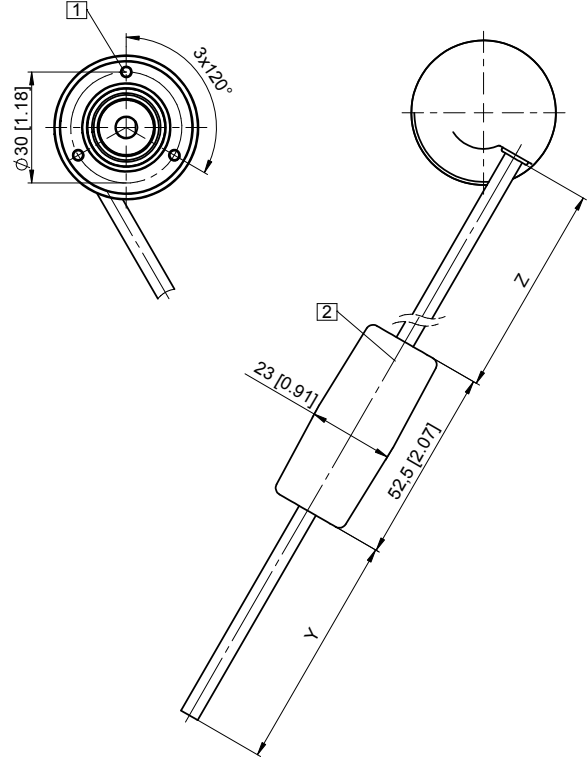
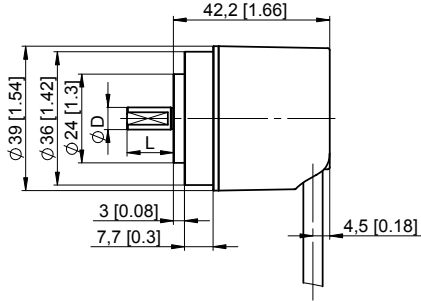
**SSI / BiSS**

## Dimensions shaft version

Dimensions in mm [inch]

### Clamping flange, $\varnothing 36$ [1.42] Flange type 1 and 3

- 1 3 x M3, 6 [0.24] deep
- 2 Battery (in the cable)



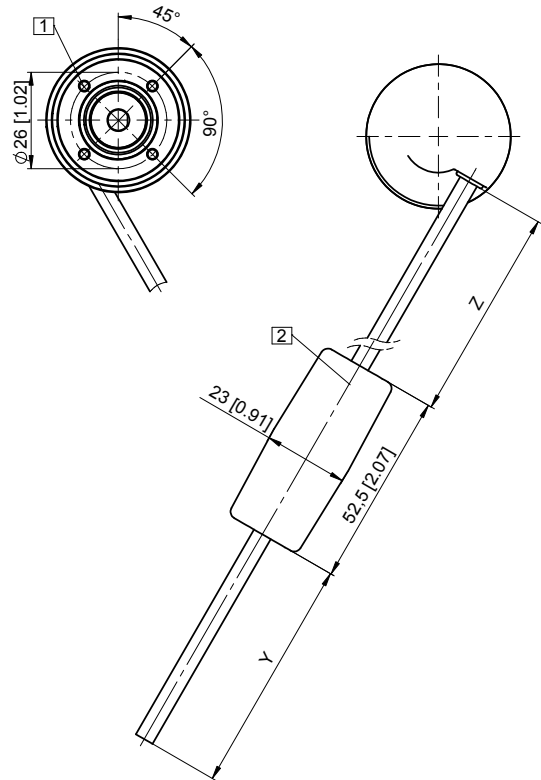
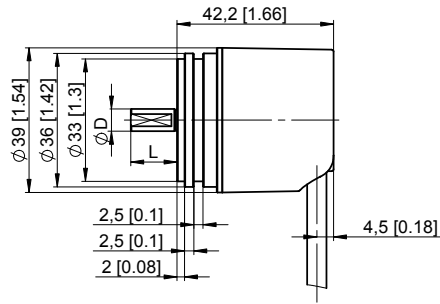
| D         | Fit | L           |
|-----------|-----|-------------|
| 6 [0.24]  | h7  | 12.5 [0.49] |
| 8 [0.32]  | h7  | 15 [0.59]   |
| 10 [0.39] | f7  | 20 [0.79]   |
| 1/4"      | h7  | 12.5 [0.49] |
| 3/8"      | h7  | 5/8"        |

| Y            | Z              |
|--------------|----------------|
| 1 m [3.28']  | 0.15 m [0.49'] |
| 5 m [16.40'] | 0.15 m [0.49'] |

### Synchro flange, $\varnothing 36$ [1.42] Flange type 2 and 4

(drawing with cable)

- 1 4 x M3, 6 [0.24] deep
- 2 Battery (in the cable)



| D         | Fit | L           |
|-----------|-----|-------------|
| 6 [0.24]  | h7  | 12.5 [0.49] |
| 8 [0.32]  | h7  | 15 [0.59]   |
| 10 [0.39] | f7  | 20 [0.79]   |
| 1/4"      | h7  | 12.5 [0.49] |
| 3/8"      | h7  | 5/8"        |

| Y            | Z              |
|--------------|----------------|
| 1 m [3.28']  | 0.15 m [0.49'] |
| 5 m [16.40'] | 0.15 m [0.49'] |

# Absolute encoders – multiturn

**Compact electronic multiturn, optical**

**Sendix F3663 / F3683 (shaft / hollow shaft)**

**SSI / BiSS**

## Dimensions hollow shaft version

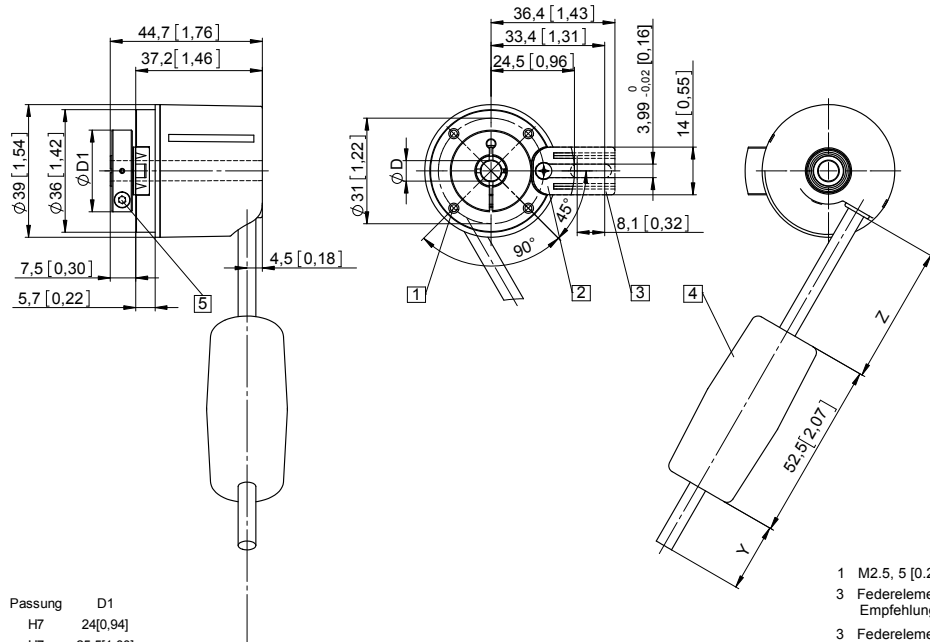
Dimensions in mm [inch]

### Flange with spring element

#### Flange type 1 and 3

(drawing with spring element short, spring element long is shown dashed)

- 1 4 x M2.5, 5 [0.20] deep
- 2 Spring element, short recommendation: cylindrical pin DIN 7,  $\varnothing$  4 [0.16]
- 3 Spring element, long recommendation: cylindrical pin DIN 7,  $\varnothing$  4 [0.16]
- 4 Battery (in the cable)
- 5 Recommended torque for the clamping ring 0.6 Nm



| Passung | D1         |
|---------|------------|
| H7      | 24[0,94]   |
| H7      | 25,5[1,00] |
| H7      | 25,5[1,00] |

- 1 M2.5, 5 [0.2] ti
- 3 Federelement Empfehlung: Zyl
- 3 Federelement Empfehlung: Zyl

| D            | Fit | D1          |
|--------------|-----|-------------|
| 6 [0.24]     | H7  | 24 [0.94]   |
| 8 [0.32]     | H7  | 25.5 [1.00] |
| 10 [0.39] *) | H7  | 25.5 [1.00] |
| 1/4"         | H7  | 24 [0.94]   |

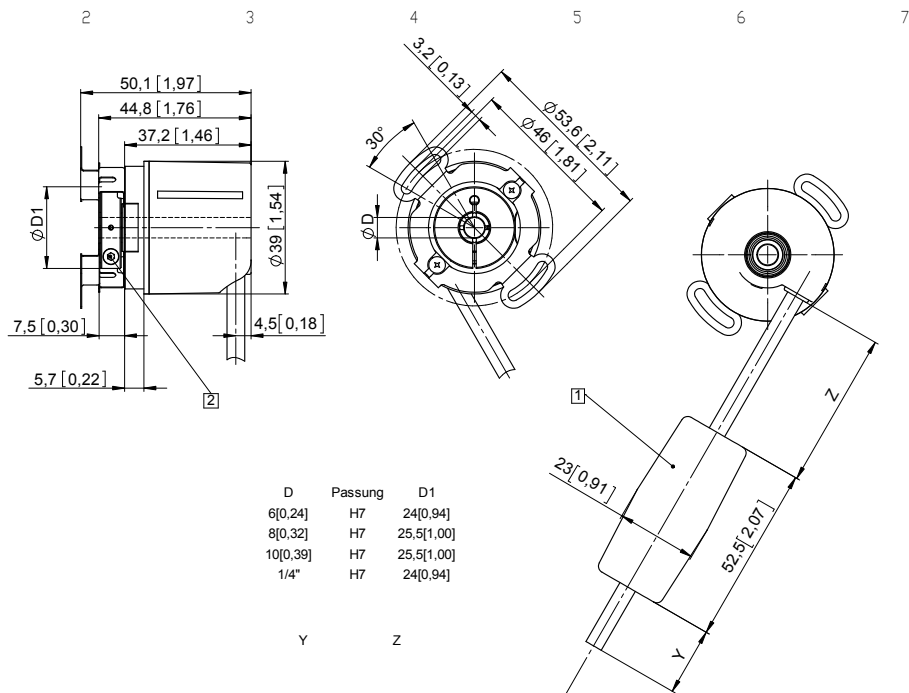
\*) Blind hollow shaft, insertion depth max. = 14.5 mm [0.57"]

| Y            | Z              |
|--------------|----------------|
| 1 m [3.28']  | 0.15 m [0.49'] |
| 5 m [16.40'] | 0.15 m [0.49'] |

### Flange with stator coupling, $\varnothing$ 46 [1.81]

#### Flange type 2

- 1 Battery (in the cable)
- 2 Recommended torque for the clamping ring 0.6 Nm



| D            | Fit | D1          |
|--------------|-----|-------------|
| 6 [0.24]     | H7  | 24 [0.94]   |
| 8 [0.32]     | H7  | 25.5 [1.00] |
| 10 [0.39] *) | H7  | 25.5 [1.00] |
| 1/4"         | H7  | 24 [0.94]   |

\*) Blind hollow shaft, insertion depth max. = 14.5 mm [0.57"]

| Y            | Z              |
|--------------|----------------|
| 1 m [3.28']  | 0.15 m [0.49'] |
| 5 m [16.40'] | 0.15 m [0.49'] |

| D        | Passung | D1         |
|----------|---------|------------|
| 6[0,24]  | H7      | 24[0,94]   |
| 8[0,32]  | H7      | 25,5[1,00] |
| 10[0,39] | H7      | 25,5[1,00] |
| 1/4"     | H7      | 24[0,94]   |

Y Z

Subject to change without prior notice.

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